08/30/2006

ASARCO EAST HELENA SMELTER
GROUNDWATER CORRECTIVE ACTION PLAN - 2006

Asarco East Helena Smelter

East Helena, Montana 59635

Prepared by:

ASARCO LLC
P.O. Box 1230
East Helena, MT 59635

August 30, 2006

ASARCO EAST HELENA SMELTER
GROUNDWATER CORRECTIVE ACTION PLAN - 2006

Asarco East Helena Smelter

East Helena, Montana 59635

Prepared by:

ASARCO LLC
P.O. Box 1230
East Helena, MT 59635

August 30, 2006

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ASARCO EAST HELENA SMELTER
GROUNDWATER CORRECTIVE ACTION PLAN - 2006

1.0 INTRODUCTION

In January 1998, the United States Environmental Protection Agency (EPA) and ASARCO LLC (Asarco) entered into a Consent Decree (CV 98-3-H-CCL) under the Resource Conservation and Recovery Act (RCRA) that required Asarco to investigate and correct releases of arsenic and metals in groundwater and soils at the East Helena Smelter. As part of this Decree, Asarco has completed several investigations and prepared several site investigation documents including:

- RCRA Current Conditions/Release Assessment (CC/RA) (Hydrometrics, 1999a).
- Interim Measures Work Plan, East Helena Facility (Hydrometrics, 1999b).
- RCRA Facility Investigation (RFI) Work Plan (Hydrometrics, 2000a).
- Phase I RCRA Facility Investigation Report (Asarco Consulting Inc. (ACI) 2003, revised 2005).

On October 4, 2005, Asarco received a letter from EPA that summarized EPA's decision to defer development of the Phase II RCRA RFI Work Plan, and instead focus on evaluation of additional interim measures that address groundwater. During April 25-26, 2006, Asarco, EPA, and the Montana Department of Environmental Quality (MDEQ), met at EPA offices in Denver in a working session to evaluate existing site conditions and outline a strategy for groundwater remedial measures at the site. MDEQ's participation addressed the need for coordination of plant facility cleanup activities associated with a State of Montana Consent Decree (CDV-2004-212) with Asarco.

Based on earlier meetings between Asarco, EPA and MDEQ in March 2006, it was recognized that Montana Consent Decree activities that consist primarily of process unit

cleanup and building demolition would require coordination with any groundwater corrective actions implemented as part of the RCRA program. In addition, a key component of facility process unit material removal and associated site demolition is the construction of a CAMU Phase 2 cell for containment of demolition debris. This project also requires coordination between all parties.

2.0 PROPOSED INTERIM CORRECTIVE MEASURES FOR GROUNDWATER

EPA has expressed its preference for passive corrective measures implemented for groundwater at the East Helena site. These measures could include in situ containment such as slurry walls and capping, or in situ treatment options such as soil fixation or permeable barrier walls. As a result of discussions between EPA, Asarco, and MDEQ, groundwater corrective actions will focus on three general areas:

1. The former acid plant sediment drying area (see Figure 1);
2. The speiss/dross area (see Figure 1); and
3. The elevated groundwater arsenic plume down-gradient from these areas (see Figure 1).

The former acid plant sediment drying area has been identified as a significant source area with high arsenic groundwater concentrations. The speiss/dross area also has been identified as a significant source of elevated arsenic and metal concentrations in groundwater and is the primary source of a relative narrow, high concentration plume that extends from the East Helena Plant into the City of East Helena.

In summer of 2005, EPA constructed a 30-foot pilot test permeable reactive barrier (PRB) wall to evaluate the potential of in situ treatment of the arsenic plume down gradient of these source areas. The result of this test is on-going, with additional data expected to become available later in 2006.

As a result of the April 2006 meetings between EPA, Asarco, and MDEQ, and the follow-up of several action items as a result of the meetings (including preparation of cost estimates by engineers and contractors), the general strategy for groundwater corrective actions at the East Helena Facility is as follows:

- Slurry wall construction and capping of the former acid plant sediment drying area. The general trace of this proposed slurry wall is shown on Figure 1.

- Slurry wall construction and capping of the speiss/dross area. The general trace of the proposed slurry wall is shown on Figure 1.
- Construction of a PRB wall (s) near the area of the present PRB test wall. One proposed wall location is shown on Figure 1.

The slurry wall design and construction for the former acid plant sediment drying area is scheduled for Fall 2006. The slurry wall construction in the speiss/dross area is scheduled for 2007 after demolition of structures in the area is completed, which are presently being conducted in summer/fall 2006. Down gradient PRB construction is expected to occur in 2007 or 2008.

3.0 DESIGN AND CONSTRUCTION OF A SLURRY WALL AND CAP IN THE FORMER ACID PLANT SEDIMENT DRYING AREA

Figure 2 show the conceptual design of a slurry wall and both a temporary and permanent cap in the former acid plant sediment drying area. The temporary cap would be used only if time and/or weather constraints did not permit construction of a permanent cap in 2006.

3.1 SLURRY WALL DESIGN

The slurry wall in the former acid plant sediment drying area will consist of a 5-foot thick wall composed of a mixture of bentonite or bentonite/cement slurry and soils. The wall will be placed using the same deep excavation equipment that was successfully used to construct the PRB pilot test wall in 2005. The wall will extend from the surface through unsaturated and saturated alluvial sediments composed of permeable sand, silt, gravel and cobbles (see Detail 3, Figure 2). The objective of wall design and construction is to isolate groundwater and sediments that act as sources of elevated arsenic concentrations in downgradient groundwater. In general the slurry wall design is as follows:

- The wall is 940 feet long (220 ft x 250 ft), 32 feet deep and 5 feet wide.
- The wall will be keyed 2-feet into a low permeability volcanic ash-clay that underlies the alluvial sediments.
- The wall will be constructed using excavation equipment used for the test PRB wall.
- Standard bentonite grout will be used for slurry wall construction. Fine-grained soil will be imported if necessary based on slurry design testing presently being conducted. Other slurry design options may include the addition of cement additives to the slurry if necessary; based on wall design testing results.

3.2 TEMPORARY CAP DESIGN

As described above, a temporary cap would be used in the slurry wall area only if time and/or weather constraints did not permit construction of a permanent cap. The purpose

of the temporary cap is to inhibit infiltration from precipitation until a permanent cap could be installed. The conceptual design of a temporary cap is shown in Detail 1 in Figure 2. In general, from the top down, the temporary cap will consist of the following:

- Sand bags to hold down the temporary cover during windy periods.
- A 24-mil reinforced polyethtylene (RPE). The seams in the RPE will be overlapped 3 inches and sealed with a butyl rubber seaming tape.
- A minimum 10 ounce non-woven geotextile.
- A prepared sub-grade consisting of source soils from the excavation trench and/or fine-grained slag fill for grading purposes.
- Existing soils

3.3 PERMANENT CAP DESIGN

The conceptual design for the permanent cap design is shown in Detail 2 of Figure 2. The purpose of the permanent cap is to provide a permanent cover that would isolate underlying soils from any potential direct contact and prevent infiltration of precipitation into underlying soils and groundwater within the slurry wall area. In general, from the top down, the permanent cap will consist of the following:

- A top soil (6 inches) cover to provide a medium for vegetation growth. The topsoil cap will be seeded with a designed seed mixture, similar to that used for the CAMU Phase 1 Cell cover. The seed mixture will consist predominately of native grasses and other plants that will establish quickly and limit the presence of noxious weeds.
- A sub-soil (18 inches) consisting of clean sand, silt and/or clay. The subsoil provides a protective cover for underlying layers.
- A geonet for drainage of underlying layers. The cap will be graded to meet stormwater drainage design.
- A Geosynthetic Clay Liner (GCL), which is a sandwich of bentonite clay and PVC liner to prevent downward infiltration into underlying soils.

- A prepared sub-grade consisting of source soils from the excavation trench and/or fine-grained slag fill for grading purposes.
- Existing soils.

Table 1 shows the specifications for the various layers of the permanent cap.

TABLES

TABLE 1. PERMANENT CAP SPECIFICATIONS

SPECIFICATIONS FOR GEOSYNTHETIC CLAY LINER (GCL)

Category	Parameter	Value or Description
Material	Sealing Agent	Sodium Bentonite
	Reinforcement	Yes - Needlepunch
	Permeability	5 X 10^{-9} cm/sec Nominal 1X 10^{-7} cm/sec Max.;
Placement	Subgrade Preparation	95% Modified Proctor Maximum 0.5" Relief
	Seaming	6" Longitudinal 24" End-of Roll
	Bentonite-Enhanced Seams	1/4 lb. Per Linear Foot
	Anchoring	24" Depth 18" Return
	Alignment	Parallel to Slope
	Maximum Slope	2H:1V
	Penetrations	Flow Away From Penetration, Seal with Bentonite Granules

SPECIFICATIONS FOR GEONET DRAINAGE LAYER

Category	Parameter	Value or Description
Material	Permeability	Min. 10 cm^2/sec
	Thickness	0.0305 inches or as approved
Placement	Subgrade Preparation	On GCL or CCL Maximum 0.5" Relief
	Seaming	6" Longitudinal 12" End-of Roll
	Anchoring	Friction
	Alignment	Parallel to Slope
	Maximum Slope	2H:1V
	Confining Pressures	1.5 TSF
	Penetrations	Positive Flow - Sealed with Bentonite Granules

TABLE 1. PERMANENT CAP SPECIFICATIONS (continued)

SPECIFICATIONS FOR COVER LAYER

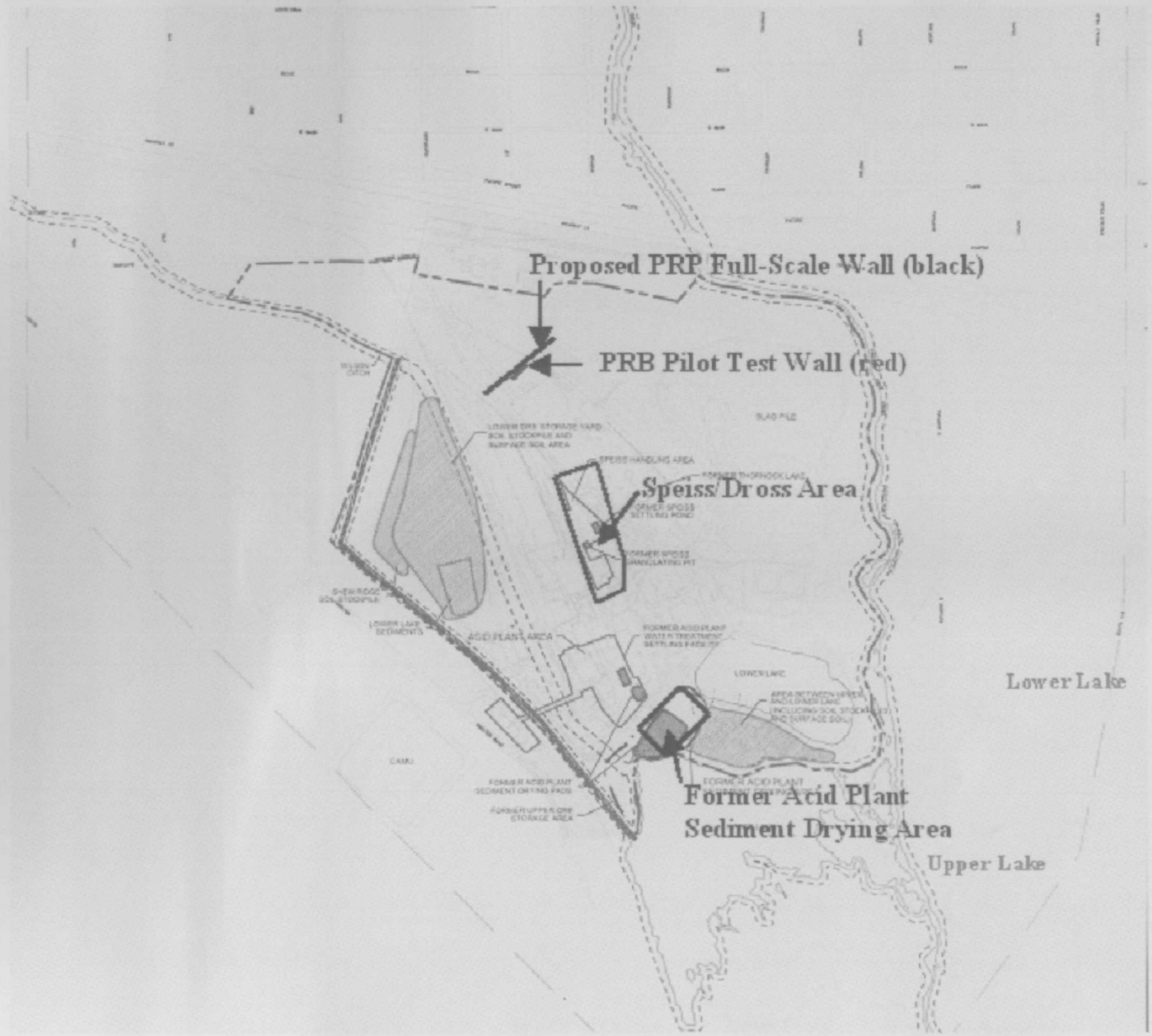
Category	Parameter	Value or Description
Material	Hydroseeded Soil	Seed Mix Same as Existing CAMU Cap.
Placement	As Required	As Required

FIGURES

Color Map(s)

The following pages contain color that does not appear in the scanned images.

To view the actual images, contact the Region VIII Records Center at (303) 312-6473.

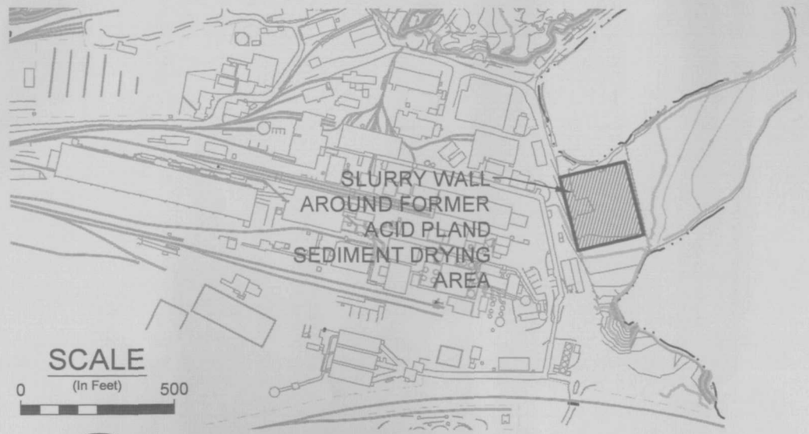


SOURCE AREA
LOCATION MAP

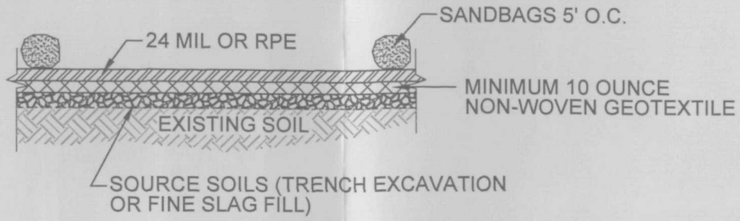
FIGURE
1

UPDATE TIME: 8:21AM
SDP \HEL\090606\I:\Land Projects\605201\DWG\605201h002.dwg

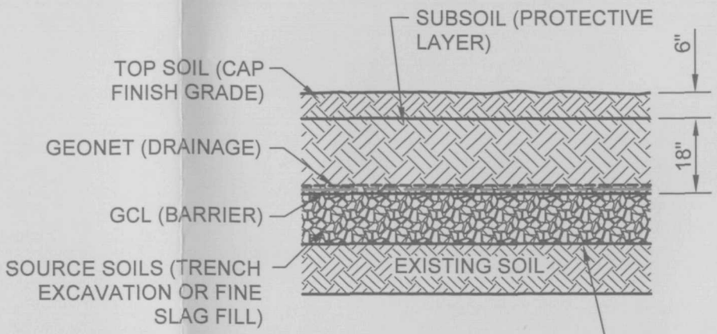
Hydrometrics, Inc.
Consulting Scientists and Engineers



PLANT SITE - PLAN VIEW

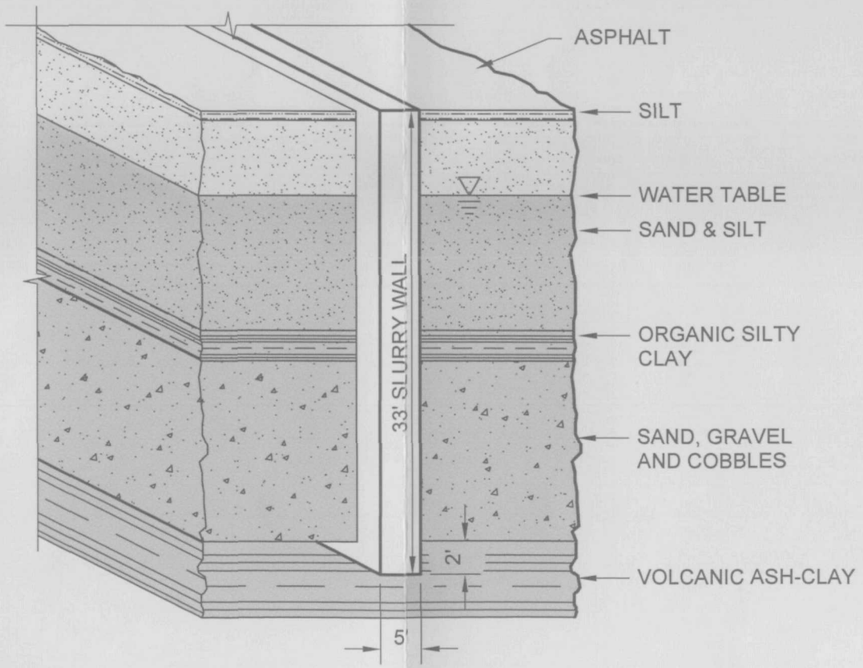


1 - DETAIL
TEMPORARY CAP
NTS



2 - DETAIL
PERMANENT CAP
NTS

SLURRY WALL - PLAN VIEW



3 - DETAIL
TYPICAL SLURRY WALL CROSS SECTION
NTS

	CONCEPTUAL DESIGN SLURRY WALL, TEMPORARY CAP AND PERMENANT CAP	FIGURE 2

UPDATE TIME: 10:08AM
JSD \HEL\090506\I:\Land Projects\605201\DWG\605201h001.dwg

Hydrometrics, Inc.
Consulting Scientists and Engineers